

temperature when reacting is 90°C or less, then crystallizing optically active α -hydroxycarboxylic acid in an aqueous solution.

19. (New) An optically active chloromandelic acid crystalline whose packing density is more than 0.5 g/cm³.

REMARKS

Following entry of this amendment, claims 1-3, 7-9, 11, and 13-19 are pending in the application. Support for the amendment to claims 3 and 7 can be found in the specification, e.g., at page 17, first full paragraph. Support for new claim 14 can be found in the specification, e.g., at page 17, last paragraph. Support for new claims 15 and 16 can be found in the specification, e.g., at page 18, second full paragraph. Support for new claims 17 and 18 can be found in the specification, e.g., at page 5, second full paragraph, at page 6, second full paragraph, and at page 17, first full paragraph. Further support for new claim 18 can be found in the specification, e.g., at page 6, first paragraph. Support for new claim 19 can be found in the specification, e.g., at page 46, first full paragraph.

Rejection Under 35 U.S.C. § 112, First Paragraph

The Examiner rejected claims 3 and 6 under 35 U.S.C. § 112, first paragraph, alleging that "the specification, while being enabled for mineral acids such as hydrochloric acid, sulfuric acid, nitric acid, boracic acid, phosphoric acid, perchloric acid, does not reasonably provide enablement for all the mineral acids." Action at page 2, item 1. Solely to expedite prosecution and without acquiescing to the rejection, applicants have canceled claim 6 and have amended

claim 3 to recite a "mineral acid selected from hydrochloric acid, sulfuric acid, boracic acid, phosphoric acid, and perchloric acid."

In view of the foregoing amendment, applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, first paragraph.

Rejections Under 35 U.S.C. § 102(b)

The Examiner rejected claims 1-4, 6, 8-9, and 11-13 under 35 U.S.C. § 102(b) for allegedly being anticipated by Shiono et al. (U.S. Patent No. 4,694,090; hereafter "Shiono"). The Examiner alleged that "Shiono et al disclose a process of making α -hydroxycarboxylic acid by hydrolyzing a cyanohydrin in the presence of a mineral acid such as a hydrochloric acid and a high boiling alcohol such as glycerol, ethylene glycol (see col. 6, lines 1-11) at room temperature or under heating...." Action at page 3, item 3. The Examiner further stated that in Shiono, "water is added to the reaction mixture and then the whole mixture is extracted with diethyl ether and washed with water, dried; the solvent in the reaction mixture is distilled off, and the residue is then purified by recrystallization...." *Id.*

Solely to expedite prosecution and without acquiescing to the rejection, applicants have canceled claims 4, 6, and 12. Applicants have added new claims 14-16, which depend from claim 1. Applicants therefore address the rejection with respect to claims 1- 3, 8, 9, 11, and 13-16.

Claim 1 recites "[a] method for producing α -hydroxycarboxylic acid, which comprises hydrolyzing cyanohydrin in the presence of a hydrocarbon solvent." Claims 2, 3, 11, and 14-16 depend from claim 1. The specification defines a hydrocarbon solvent as "an organic compound consisting of carbon atoms and hydrogen atoms only." Specification at page 17. Shiono, in

contrast, uses a "high boiling alcohol such as glycerol, ethylene glycol, methylcellosolve, etc." Shiono at column 6, lines 10-11. Applicants assert that a hydrocarbon solvent is distinctly different from an alcohol solvent in that an alcohol comprises carbon, hydrogen and oxygen, while a hydrocarbon molecule consists of only carbon and hydrogen. Shiono does not teach that a cyanohydrin is hydrolyzed in the presence of a hydrocarbon solvent. Shiono, therefore, does not anticipate claims 1-3, 11, and 14-16, because it fails to teach every limitation of the claims.

Claim 8 recites "[a] method for producing optically active crystalline α -hydroxycarboxylic acid, which comprises crystallizing optically active α -hydroxycarboxylic acid in an aqueous solution." Claim 9 is dependent from claim 8. Claims 11 and 13 also recite "crystallizing optically active α -hydroxycarboxylic acid...in an aqueous solution."

Shiono discusses purifying α -hydroxycarboxylic acid by recrystallization (see, e.g. Shiono at column 6, lines 52-56). However, Shiono uses diethyl ether and n-hexane for the recrystallization process (see, e.g., Shiono at column 25, lines 65-67), while the claimed invention uses "an aqueous solution." Shiono does not teach the use of the aqueous solution from which α -hydroxycarboxylic acid is crystallized in the present method. Therefore, applicants assert that Shiono does not anticipate claims 8-9, 11, and 13 because it fails to teach every limitation of those claims.

Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 102(b) in view of Shiono.

The Examiner rejected claim 10 under 35 U.S.C. § 102(b) as allegedly being anticipated by Flege et al. (U.S. 4,218,380). Solely to expedite prosecution and without acquiescing to the rejection, applicants have canceled claim 10. Thus, the rejection is moot.

Rejection under 35 U.S.C. § 103

The Examiner rejected claims 5 and 7 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Shiono. Specifically, the Examiner alleged that

[w]ith respect to the use of 10 equivalents of mineral acid relative to the cyanohydrin, the reference is silent. However, in the hydrolysis of hydantoin, 1-5 moles of sodium hydroxide are used per mole of hydantoin (see col. 4, lines 33-35). Furthermore, Shiono et al do teach that hydrochloric acid and sodium hydroxide are equivalent to each other in the hydrolysis."

Action at page 6, item 7.

Solely to expedite prosecution and without acquiescing to the rejection, claim 5 has been canceled. Claim 7 recites

[a] method for producing optically active α -hydroxycarboxylic acid, which comprises hydrolyzing optically active cyanohydrin, using at most 10 equivalents of mineral acid selected from hydrochloric acid, sulfuric acid, boracic acid, phosphoric acid and perchloric acid relative to said optically active cyanohydrin under the condition that maximum temperature when reacting is 90°C or less.

Applicants have added claims 17 and 18, each of which also recites "using at most 10 equivalents of mineral acid selected from hydrochloric acid, sulfuric acid, boracic acid, phosphoric acid and perchloric acid relative to said optically active cyanohydrin." Therefore, applicants will address the rejection with respect to claims 7, 17, and 18.

Applicants assert that the hydrolysis of cyanohydrin is different from the hydrolysis of hydantoin in its reaction mechanism. Furthermore, acid-catalyzed hydrolysis, such as that catalyzed by a mineral acid selected from hydrochloric acid, sulfuric acid, boracic acid, phosphoric acid and perchloric acid, differs significantly from alkali-catalyzed hydrolysis, such as that catalyzed by sodium hydroxide. It is known in the art that there is high probability of racemization in alkali-catalyzed hydrolysis, as compared with acid-catalyzed hydrolysis.

Claims 7, 17, and 18 are directed to a method of producing optically active α -hydroxycarboxylic acid with high optical purity by hydrolysis of optically active α -cyanohydrin.

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To obtain optically active α -hydroxycarboxylic acid with high optical purity, the reaction conditions are carefully controlled. The claimed method can be achieved by hydrolyzing optically active α -cyanohydrin with a mineral acid at a temperature of up to 90°C, using at most 10 equivalents of mineral acid relative to cyanohydrin. When hydrolysis is carried out with more than 10 equivalents of mineral acid, or at a temperature greater than about 90°C, the optical purity or yield of α -hydroxycarboxylic acid may be significantly reduced. See, e.g., specification at Examples 1 and 2 and Table 4.

In contrast, Shiono does not teach or suggest hydrolyzing optically active α -cyanohydrin at a temperature of 90°C or lower, or in the presence of at most 10 equivalents of mineral acid. Moreover, Shiono also does not teach or suggest that such a method results in a high yield of optically active α -hydroxycarboxylic acid with a high optical purity. Therefore, applicants assert that Shiono does not render the claimed invention obvious.

In view of the foregoing arguments, applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a) over Shiono.

Applicants respectfully assert that the present application is in condition for allowance and request that the Examiner issue a timely Notice of Allowance for pending claims 1-3, 7-9, 11, and 13-19. If the Examiner does not consider the application to be allowable, the undersigned requests that, prior to taking action, the Examiner call her at (650) 849-6607 to set up an interview.

Please grant any extensions of time required to enter this response and charge any additional required fees to our Deposit Account No. 06-0916.

Respectfully submitted,

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Dated: April 17, 2002

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APPENDIX TO AMENDMENT AND RESPONSE

Version with Markings to Show Changes Made

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IN THE CLAIMS:

Please amend claims 3 and 7 to read:

3. (Amended) The method for producing α -hydroxycarboxylic acid according to claim 1, wherein the hydrolysis reaction is carried out using mineral acid selected from hydrochloric acid, sulfuric acid, boracic acid, phosphoric acid, and perchloric acid.

7. (Amended) A method for producing optically active α -hydroxycarboxylic acid, which comprises hydrolyzing optically active cyanohydrin, using at most 10 equivalents of mineral acid selected from hydrochloric acid, sulfuric acid, boracic acid, phosphoric acid and perchloric acid relative to said optically active cyanohydrin under the condition that maximum temperature when reacting is 90°C or less.